Math 947, Mathematical Theory of Fluid Dynamics, 3 credit hours, Fall, 2016,

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Office Hours:	MW 3:00–4:00 PM and after class
Classroom; Days/Time:	Jabara Hall Room 335; MW 5:35–6:50 PM
Prerequisites:	Math 745

How to use this syllabus

This syllabus provides you with information specific to this course, and it also provides information about important university policies. This document should be viewed as a course overview; it is not a contract and is subject to change as the semester evolves. (Indicate if any changes will be made and how they will be communicated to the student.)

Academic Honesty

Students are responsible for knowing and following the Student Code of Conduct http://webs.wichita.edu/inaudit/ch8_05.htm and the Student Academic Honesty policy http://webs.wichita.edu/inaudit/ch2_17.htm. *[If your department or college has a policy on academic honesty, insert a link here. Also, be sure to specify which penalties you will pursue under the above policies when you discover cases of academic dishonesty.*

Course Description

Mechanics of fluid flow, momentum and energy priciples, Navier-Stokes equations, potential flows, vortex dynamics, stability analysis and numerical methods applied to fluid dynamics.
This semester particular attention will be given to applications of complex analysis and numerical conformal mapping to computations of potential flow.

Definition of a Credit Hour

Example for 3 credit hour class: Success in this 3 credit hour course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction and preparation/studying or course related activities for a total of 135 hours. *Go to: http://webs.wichita.edu/?u=academicaffairs&p=/definitionandassignmentofcredithours/ for the policy and examples for different types of courses and credit hour offerings.*

Measurable Student Learning Outcomes

Upon successful completion of this course, students will be able to:

- Derive equations of fluid mechanics and solve them in special cases.

- Compute solutions to potential flow problems.

- Calculate lift and drag.

- Write, debug, and run MATLAB code for conformal mapping.

- Solve problems using boundary layer theory.

- Solve examples of initial value problems for pdes of gas dynamics.

Required Texts/Readings Textbook

An Introduction to Theoretical Fluid Mechanics by Stephen Childress, AMS Courant Lecture Notes 19, 2009, available in WSU bookstore.

Other Readings

Other useful references
1. *Elementary Fluid Dynamics* by D. J. Acheson, Oxford, 1990 (reprinted 2005).
2. *Shape and Flow–The Fluid Dynamics of Drag* by A. H. Shapiro, Doubleday, Garden City, NY, 1961, nice non-mathematical explanations of fluid experiments to accompany videos; see, e.g., `http://ms.mcmaster.ca/~bprotas/MATH749a/`
3. *Theoretical Aerodynamics* by L. M. Milne-Thompsson, Dover, 1953 will be a useful source for applications of complex analysis.

My introductory notes on complex analysis and conformal mapping will be available; see also my tutorial on *Fourier Series Methods for Numerical Conformal Mapping of Smooth Domains*
`http://www.math.wichita.edu/~delillo/TD_tutorial.pdf`

MATLAB code will be made available for numerical conformal mapping and potential theory problems, as needed, through my department webpaged or Blackboard

Other Equipment/Materials

You will have access to MATLAB. However, it is strongly recommended that you purchase the student edition of MATLAB for your laptop.

Class Protocol

Attendance will be taken each class and regular attendance is expected. Late homework will not be accepted once the assignment has been graded and returned.

Grading Scale

WSU uses a $+/-$ grading scale for final grades and to calculate grade point averages. In this class, grades are assigned according to the following chart. (Note: the chart below is a sample that may be used). (Other classes might assign grades differently: Be sure to understand the different grading scales in all of your classes.)

Points/percentages, as instructor chooses (tentative)	Letter grade	Grade Points	Interpretation
90-100	A	4.00	*The A range denotes excellent performance.*
87-89	A−	3.70	
83-89	B+	3.30	
80-82	B	3.00	*The B range denotes good performance.*
77-79	B-	2.70	
73-76	C+	2.30	
70-72	C	2.00	*The C range denotes satisfactory*
67-69	C-	1.70	
63-66	D+	1.30	
60-62	D	1.00	*The D range denotes unsatisfactory*
57-59	D-	0.70	
Below 57	F	0.00	*F denotes failing performance.*

Assignments

There will be weekly written assignments as listed in the Table below for 25% of the grade. The midterm on the first half of the course and the final on the last half of the course are each 25% of the grade. There will be a programming assigment or short team project worth 25% of the grade to be determined in consultation with the students and due on the last day of class.

Late Assignments

Late assignments will not be accepted after the assignmennt has been graded and returned to the class.

Missed Assignments and Exams

Missing exams is highly discouraged. Contact me before the exam, if possible, if you are ill or have a personal reason to miss the exam.

Important Academic Dates

- For Fall semester 2016, classes begin Mon., August 22, 2016 and end on Thurs. Dec. 8, 2016.
- The last date to drop a class and receive a W (withdrawn) instead of F (failed) is Tues., Nov. 1, 2016.
- There are no classes on Oct. 15-18 for Fall break and Nov. 23-27 for Thanksgiving.
- The final exam is Wed., Dec. 14, 2016, 5:40–7:30 PM, in the classroom.

Disabilities

If you have a physical, psychiatric/emotional, or learning disability that may impact on your ability to carry out assigned course work, I encourage you to contact the Office of Disability Services (DS). The office is located in Grace Wilkie Annex, room 150, (316) 978-3309 (voice/tty) (316-854-3032 videophone). DS will review your concerns and determine, with you, what academic accommodations are necessary and appropriate for you. All information and documentation of your disability is confidential and will not be released by DS without your written permission.

Counseling & Testing

The WSU Counseling & Testing Center provides professional counseling services to students, faculty and staff; administers tests and offers test preparation workshops; and presents programs on topics promoting personal and professional growth. Services are low cost and confidential. They are located in room 320 of Grace Wilkie Hall, and their phone number is (316) 978-3440. The Counseling & Testing Center is open on all days that the University is officially open. If you have a mental health emergency during the times that the Counseling & Testing Center is not open, please call COMCARE Crisis Services at (316) 660-7500.

Diversity and Inclusive

Wichita State University is committed to being an inclusive campus that reflects the evolving diversity of society. To further this goal, WSU does not discriminate in its programs and activities on the basis of race, religion, color, national origin, gender, age, sexual orientation, gender identity, gender expression, marital status, political affiliation, status as a veteran, genetic information or disability. The following person has been designated to handle inquiries regarding nondiscrimination policies: Executive Director, Office of Equal Opportunity, Wichita State University, 1845 Fairmount, Wichita KS 67260-0138; telephone (316) 978-3186.

Intellectual Property

Wichita State University students are subject to Board of Regents and University policies (see http://webs.wichita.edu/inaudit/ch9_10.htm) regarding intellectual property rights. Any questions regarding these rights and any disputes that arise under these policies will be resolved by the President of the University, or the Presidents designee, and such decision will constitute the final decision.

Shocker1/ Alert System

Get the emergency information you need instantly and effortlessly! With the Shocker Alert System, we will contact you by email the moment there is an emergency or weather alert that affects the campus. Sign up at www.wichita.edu/alert.

Title IX

Title IX of the Educational Amendments of 1972 prohibits discrimination based on sex in any educational institution that receives federal funding. Wichita State University does not tolerate sex discrimination of any kind including: sexual misconduct; sexual harassment; relationship/sexual violence and stalking. These incidents may interfere with or limit an individuals ability to benefit from or participate in the Universitys educational programs or activities. Students are asked to immediately report incidents to the University Police Department, (316) 978-3450 or the Title IX Coordinator (316) 978-5177. Students may also report incidents to an instructor, faculty or staff member, who are required by law to notify the Title IX Coordinator. If a student wishes to keep the information confidential, the student may speak with staff members of the Counseling and Testing Center (316) 978-3440 or Student Health Services (316)978-3620. For more information about Title IX, go to: `http://www.wichita.edu/thisis/home/?u=titleixf`

Video and Audio Recording

Video and audio recording of lectures and review sessions without the consent of the instructor is prohibited. Unless explicit permission is obtained from the instructor, recordings of lectures may not be modified and must not be transferred or transmitted to any other person, whether or not that individual is enrolled in the course.

Tentative Schedule for 15 week class

Week	Date	Topics, Readings, Assignments, Deadlines (tentative!)
1	8/22, 24	Chap 1-The Fluid Continuum, HW: 1.1, 1.3, due 8/31
2	8/29	Chap 2 - Conservation of Mass and Momentum, HW: 2.1, 2.2, due 9/7
	8/31	Example 2.5 and Acheson, Chap 3 - Water waves and Stokes waves
3	9/5, 7	Chap 3 - Vorticity, HW: 3.1, 3.2, due 9/14
4	9/12, 14	Chap 4 - Potential Flow, HW: 4.1, 4.2, due 9/21
5	9/19, 21	Chap 5 - Lift and Drag in Ideal Fluids, HW: 5.1, 5.2, 5.3, due 9/28
6	9/26, 28	Introduction to of numerical conformal mapping
		Matlab demo
7	10/3, 5	Applications of conformal mapping
		Possible projects
8	10/10	Chap 6 - Viscosity and Navier-Stokes Equations, HW: 6.1, due 10/19
	10/12	Exam I on Chaps 1 thru 5
9	10/19	Chap 7 - Stokes Flow
10	10/24, 26	Chap 7 - Stokes Flow, cont., HW: 7.1, 7.2, due 11/2
11	10/31, 11/2	Chap 8 - The Boundary Layer, HW: 8.1, due 11/8
12	11/7, 9	Chap 9 - Energy, HW: 9.1, due 11/16
13	11/14, 16	Chap 10 - Sound, HW: 10.2, due 11/28
14	11/21	Chap 11 - Gas Dynamics, HW: 11/1, due 11/30
15	11/28	Chap 11 - Gas Dynamics, cont.
	11/30	Chap 12 - Shock Waves, HW: 12.1, due 12/7
16	12/5, 7	Chap 12 - Shock Waves, cont.
Final	12/14	On Chaps 6 thru 12, in classroom, 5:40-7:30 PM